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| 10/711,649 | 09/29/2004 | Kohei Kawamura | SSIT-114 | 5648 |
| 37694 | 7590 | 03/07/2006 | EXAMINER | |
| WOOD, HERRON & EVANS, LLP (TOKYO ELECTRON) | | | HARRISON, MONICA D | |
| 2700 CAREW TOWER | | | ART UNIT | |
| 441 VINE STREET | | | PAPER NUMBER | |
| CINCINNATI, OH 45202 | | | 2813 | |

DATE MAILED: 03/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,649

Applicant(s)

KAWAMURA ET AL.

Examiner

Monica D. Harrison

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 September 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1/3/06 11/21/05 4/14/05 5/27/05
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 7 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Sieber et al (US 2005/0176230 A1).

1. Regarding claim 1, Sieber et al discloses a method of processing a dielectric film, the method comprising: providing a substrate having a fluorocarbon dielectric film deposited thereon (Figure 2, reference 26), the film having an exposed surface containing contaminant (pp. 5-6, paragraphs 0051-0054); and treating the exposed surface with a supercritical carbon dioxide fluid to clean the exposed surface of the contaminants and provide surface termination (pg. 4, paragraph 0045).

2. Regarding claim 2, Sieber et al discloses wherein the contaminants comprise CH_x , H_2O , OH , or HF , or a combination of two or more thereof (pp. 5-6, paragraph 0053).

3. Regarding claim 3, Sieber et al discloses wherein the supercritical carbon dioxide fluid further comprises a solvent (pg. 4, paragraph 0045).

4. Regarding claim 4, Sieber et al discloses wherein the solvent comprises an alcohol or a silicon-containing chemical, or a combination thereof (pg. 4, paragraph 0045).

5. Regarding claim 5, Sieber et al discloses wherein the alcohol comprises methanol, ethanol, propanol, or butanol, or a combination of two or more thereof (pp. 4-5, paragraph 0046).

6. Regarding claim 7, Sieber et al discloses wherein the surface termination comprises C-F functional groups or Si-Me₃ functional groups (pp. 5-6, paragraph 0053).

7. Regarding claim 12, Sieber et al discloses depositing a metal-containing film onto the treated surface of the fluorocarbon film, wherein the surface termination improves adhesion of the metal-containing film to the fluorocarbon film (Figure 3, references 32 and 34).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6, 8-11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sieber et al (US 2005/0176230 A1) in view of Bhanap et al (US 2005/0095840 A1).

8. Sieber et al discloses all above subject matter except a silicon containing chemical (claims 6, 8 and 10) and a nitrated fluorocarbon film (claim 11).

Bhanap et al discloses a silicon containing chemical (pg.3, paragraph 0027)) and a nitrated fluorocarbon film (pp. 4-5, paragraph 0036).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Sieber et al with the teachings of Bhanap et al, for the purpose of using silicon containing chemicals in a solvent because they produce a low dielectric constant and the nitrated hydrocarbons are designed to be dissolved in any suitable solvent.

9. Regarding claim 9, Sieber et al discloses wherein the alcohol comprises methanol, ethanol, propanol, or butanol, or a combination thereof (pp. 4-5, paragraph 0046).

10. Regarding claim 12, Sieber et al discloses depositing a metal-containing film onto the treated surface of the fluorocarbon film, wherein the surface termination improves adhesion of the metal-containing film to the fluorocarbon film (Figure 3, references 32 and 34).

11. Regarding claim 13, Sieber et al discloses wherein the metal-containing film comprises tantalum (pg. 3, paragraph 0035).

Claims 14-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sieber et al (US 2005/0176230 A1) in view of Bhanap et al (US 2005/0095840 A1).

12. Regarding claim 14, Sieber et al discloses providing a substrate having a patterned fluorocarbon dielectric film formed thereon (Figure 2, reference 26) and the patterned fluorocarbon dielectric film having an exposed surface containing contaminants (pp. 5-6, paragraphs 0051-0054); treating the exposed surface with a supercritical carbon dioxide fluid to clean the exposed surface of the contaminants and provide surface termination (pg. 4, paragraph 0045). However, Sieber et al does not disclose the patterned fluorocarbon dielectric film having one or more vias or trenches or a combination thereof.

Bhanap et al discloses the patterned fluorocarbon dielectric film having one or more vias or trenches or a combination thereof (pg. 2, paragraph 0020).

It is obvious, at the time the invention was made, for one having ordinary skill in the art, to modify Sieber et al with the teachings of Bhanap et al, for the purpose of forming trenches and vias in an dielectric film in order to subject the dielectric film to a treatment which removes at least a portion of carbon containing moieties and reduces hydrophobicity of the dielectric film.

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13. Regarding claim 15, Sieber et al discloses wherein the contaminants comprise CH_x , H_2O , OH , or HF , or a combination of two or more thereof (pp. 5-6, paragraph 0053).

14. Regarding claim 16, Sieber et al discloses wherein the supercritical carbon dioxide fluid further comprises a solvent (pg. 4, paragraph 0045).

15. Regarding claim 17, Sieber et al discloses wherein the solvent comprises an alcohol or a silicon-containing chemical, or a combination thereof (pg. 4, paragraph 0045).

16. Regarding claim 18 and 22, Sieber et al discloses wherein the alcohol comprises methanol, ethanol, propanol, or butanol, or a combination of two or more thereof (pp. 4-5, paragraph 0046).

17. Regarding claims 19, 21 and 23, Bhanap et al wherein the silicon-containing chemical comprises hexamethyldisilane, hexamethyldisilazane, dimethylsilyldiethylamine, tetramethyldisilazane, trimethylsilyldimethylamine, dimethylsilyldimethylamine, trimethylsilyldiethylamine, bis-trimethylsilyl-urea, bisdimethylaminomethyl silane, bis(dimethylamino)methyl silane, dimethylaminopenomethyldisilane, dimethylaminodimethyldisilane, or a combination of two or more thereof (pg.3, paragraph 0027).

18. Regarding claim 20, Sieber et al discloses wherein the surface termination comprises C-F functional groups or Si-Me_3 functional groups (pp. 5-6, paragraph 0053).

19. Regarding claim 24, Bhanap et al discloses wherein the fluorocarbon film comprises a nitrated fluorocarbon (pp. 4-5, paragraph 0036).

20. Regarding claim 25, Sieber et al discloses depositing a metal-containing film onto the treated surface of the fluorocarbon film, wherein the surface termination improves adhesion of the metal-containing film to the fluorocarbon film (Figure 3, references 32 and 34).

21. Regarding claim 26, Sieber et al discloses wherein the metal-containing film comprises tantalum (pg.3, paragraph 0035).

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Monica D. Harrison
AU 2813

mdh
March 3, 2006


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